Preparation of a

Coliform Monitoring Plan

For Group A Public Water Systems

February 2003

DOH PUB. #331-036 (revised)

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For more information or additional copies of this document contact:

Training and Outreach Section
Division of Drinking Water
Department of Health
PO Box 47828
Olympia, WA 98504-7828
(360) 236-3164

Mary Selecky
Secretary of Health

Bill White
Assistant Secretary, Environmental Health

Gregg Grunenfelder
Director, Division of Drinking Water

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Introduction

All Group A public water systems are required by the "Group A Public Water Systems" regulations (*Chapter 246-290 WAC*) to collect samples for coliform bacteria analysis. Coliform bacteria sample collection must be based upon a written monitoring plan that identifies sampling sites throughout the distribution system. Each water system's Coliform Monitoring Plan (CMP) is subject to review by the Department of Health (DOH).
The CMP must be kept on file with the water system and made available to the department:

- During a sanitary survey;
- During a special site visit;
- As part of a Water System Plan;
- As part of a Small Water System Management Plan; or
- Upon request by the department.

This guidance manual is designed to assist in the development of a CMP. The purposes of a CMP include the following:

- Ensure representative Routine sampling.
- Identify Repeat sample sites in case Routine samples indicate a possible water quality problem.
- Provide a written guide so that more than one person associated with a water system knows where and how to collect coliform samples.
- Enhance water quality surveillance.

In general, a CMP consists of three parts: 1) a narrative description of the water system or a copy of the most current Water Facilities Inventory (WFI) form; 2) Routine and Repeat sample information; and 3) a map or schematic of the water system showing the location of Routine and Repeat sample sites. The "Plan Outline" section of this manual presents the specific elements for a successful CMP. There are examples of CMPs provided at the end of this manual.

The following DOH publications/references are mentioned in this manual and may be helpful during the development of a CMP:
"Group A Public Water Systems" rule *(Chapter 246-290 WAC)*
"Routine Coliform Monitoring Requirements"
"Types of Coliform Violations"
"Coliform Sample Collection Instructions"
"Coliform Bacteria and Drinking Water"

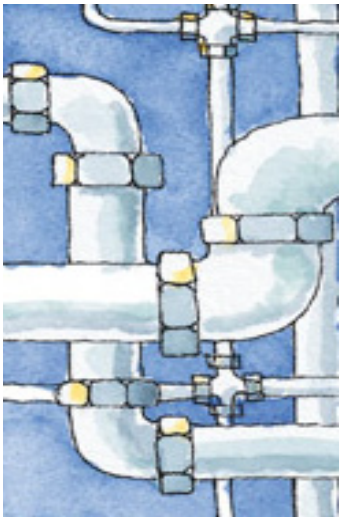
For additional copies of publications, call 1-800-521-0323. Publications are also available on the Internet at: www.doh.wa.gov/ehp/dw

Coliform Monitoring Program

The purpose of the coliform monitoring program is to enable water purveyors to evaluate the microbial water quality of a water system using economical tests. These tests help to ensure the water provided to consumers is free of disease-causing organisms.

Routine coliform samples should be collected from representative points in the distribution system at regular time intervals. When the CMP is properly developed and implemented, it should ensure that each area of the distribution system is adequately monitored on a regular basis.

Within a distribution system, coliform organisms tend to cluster and are not evenly dispersed. Therefore it is possible for two samples taken a few minutes apart from the same tap to have different results, one sample indicating the presence and the other sample indicating the absence of coliforms. A cluster of bacteria can break up, mix up, and move into other parts of the distribution system.



The minimum number of required samples is based upon the population to be served each month by the water system. The general coliform monitoring requirements are addressed in Table 2 of WAC 246-290-300 and are summarized in the DOH publication "Routine Coliform Monitoring Requirements" (DOH Pub. #331-205).

The minimum number of samples required by the regulations will likely ensure that the water quality throughout the distribution system is sufficiently monitored in a 'simple' water system. A 'simple' system is generally a system with one or two sources and a single pressure zone. For complex systems, the number of samples required by regulation may be less than is necessary to ensure representative sampling of the entire distribution system. A 'complex' system is usually a system that consists of multiple sources and /or multiple pressure zones, or has long transmission runs, or extensive distribution piping. Purveyors with complex systems are encouraged to take more than the minimum number of samples required per month, if the minimum number is not sufficient to cover all areas of the distribution system.

When taking multiple samples per month, a system must sample at regular time intervals throughout the month, i.e., samples should not all be collected on the same day, but rather on an appropriate daily, weekly, or biweekly schedule.

Coliform Sample Site Selection

Routine sample sites should be selected throughout the distribution system and should represent the varying conditions that exist in the distribution system. With properly located sites, changes in water quality can be identified, along with the possible cause for the changes. Sample sites should reflect the complexity of the system and focus on areas of concern (i.e., zones of low pressure, cross-connection hazards, deteriorating water mains, areas susceptible to stagnation due to low water use, or other questionable conditions). As noted in the sidebar, coliform bacteria are not evenly dispersed or mixed-up in the distribution

system. They tend to find "safe" places in the distribution system, such as dead end lines, and these places should be represented in the selection of sample sites. (For example, locating sample sites near dead ends, but not at the very end of lines, is strongly suggested.)

It is recommended that most systems, whether "simple" or "complex'", have a greater number of Routine sample sites than are needed each month. (For example, systems that collect one sample per month should have at least three Routine sample sites identified in the CMP.) These Routine sample sites should be rotated throughout the year. (For example, one site would be sampled in January, April, July and October; a second site would be sampled in February, May, August and November; and a third site would be sampled in March, June, September and December.)

In addition to the suspect places discussed earlier, it is recommended that each of the following be monitored on a regular basis:

- Source
- Storage (reservoir)

Mark these samples as "other" or "investigative" as they do not count towards compliance samples.

Repeat samples are required if the Routine sample(s) is unsatisfactory. Repeat sampling should be completed in accordance with the following:

For systems collecting ONE Routine sample per month, a total of **FOUR REPEAT** samples are required from the following locations:

1. The same tap as the original unsatisfactory Routine sample.
2. An active service within five active connections upstream from where the original unsatisfactory sample was taken.
3. An active service within five active connections downstream from where the original unsatisfactory sample was taken.
4. Another location, such as at the source or right after the storage tank, that will provide useful information for determining a source of contamination. If you do not have a tap at the source or storage tank, choose another active service.

For systems collecting TWO OR MORE Routine samples per month, a total of **THREE REPEAT** samples are required from the following locations:

1. The same tap as the original unsatisfactory Routine sample.
2. An active service within five active connections upstream from where the original unsatisfactory sample was taken.
3. An active service within five active connections downstream from where the original unsatisfactory sample was taken.

Careful attention should be paid to the selection of sample taps. Use of both customer service connections and dedicated sampling stations are acceptable. Dedicated sampling stations are often more accessible to the system samplers. When selecting sites, keep in mind that samples taken from a customer's service tap may be affected by conditions existing on the customer's premises and may not accurately reflect the conditions that exist in the distribution system.

Note: During Routine and Repeat sampling, a site may be determined not to represent the conditions within the distribution system. It is advised to remove that sampling site from the CMP and replace it with a site that better represents the conditions within the distribution system.

When selecting sample taps **avoid** the following:

- Swivel faucets
- Hot/cold "mixing faucets" (i.e., faucets with a single lever)
- Drinking fountains
- Janitorial sinks
- Frost-free hose bibs
- Leaking or spraying faucets
- Faucets below ground or near ground level
- Faucets served by home filters or other home treatment systems

CMP Preparation and Maintenance

A person knowledgeable of the system's distribution facilities and characteristics should prepare, as well as maintain, the CMP. A fundamental knowledge of coliform bacterial monitoring is also necessary. Once the plan is completed, it must be maintained in the water system's files and available to all system personnel involved with coliform monitoring. The CMP should be updated to reflect system or monitoring changes.

Coliform Monitoring Plan Outline

The CMP consists of six components:

A. System Information
B. Routine and Repeat Sample Locations
C. Routine Sample Rotation Schedule
D. Month Following Unsatisfactory Samples
E. Preparation Information
F. System Map

The following instructions have been designed to assist you with completing the blank form (found on page 7), which may be used as a template for the CMP for your water system.

A. System Information

Complete Box A or attach a copy of the most current WFI. This information should be updated if there is a significant change in the water system, e.g., new pressure zone, line extension, new source, or major population change.

B. Routine And Repeat Sample Locations

The specific location of all Routine sample sites should be included in Box B. The "specific location" should be the address, or other reliable way to find the site. The specific tap or faucet to be used at the site should be noted as well. Routine sample sites at the first two service connections and the last two service connections should be avoided so that Repeat samples may be colleted upstream and downstream of the Routine site. A Routine sample should never be collected from the source.

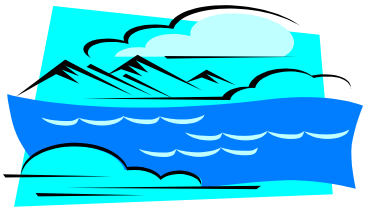
> It is recommended that a code be used to keep track of sample sites. A code will be very useful in showing the sample site locations on the map portion of the CMP.

Repeat sample sites should include the Routine site that was unsatisfactory and at least one upstream and one downstream site within five active service connections of each Routine sampling site. A fourth Repeat sample site must be identified for systems collecting one Routine sample per month; it is often best that this site be the water system source or storage tank.

C. Routine Sample Rotation Schedule

Routine sample sites should be rotated on a monthly basis. It is desirable to rotate through each important sample site about four times per year.

Systems using surface water, or ground water under the direct influence of surface water (GWI), and not practicing filtration, must identify the location of the first service connection. This connection must be available and accessible for coliform sample collection if the turbidity of the source water ever exceeds 1 NTU.



D. Month Following Unsatisfactory Samples

In the month following an unsatisfactory sample(s), a minimum of five Routine samples is required. Describe the method of selecting the sites for these samples and list the site locations. If your system collects five or more Routine samples per month, maintain your normal monitoring schedule.

E. Preparation Information

Fill in the boxes.

F. System Map

A system map may be based upon a schematic, a distribution system map (as-built) or a street map. If a detailed map is not available, a detailed sketch may be used. The following locations must be indicated on the map:

- All water sources
- Distribution system area served by each source
- Coliform sampling sites, both Routine and Repeat

In addition, when applicable, the following locations should be indicated on the map:

- Treatment facilities
- Storage tanks / reservoirs
- Pressure regulation facilities (reducing stations and booster stations)
- Pressure zones
- Critical valves and/or Interties with other water systems

Include the System Name, System ID Number, and a legend, as necessary, on the map. The map should be titled "Coliform Monitoring Plan."

Coliform Monitoring Plan for: _____

A. System Information

Water System Name	County	System I.D. Number
Attach copy of current WFI		
Number of Routine Samples Required Monthly by Regulation:	Number of Sample Sites Needed to Represent the Distribution System:	

B. Routine and Repeat Sample Locations

Location/Address for <u>Routine</u> Sample Sites	Location/Address for <u>Repeat</u> Sample Sites
X1.	1-1.
	1-2.
	1-3.
	1-4.
X2.	2-1.
	2-2.
	2-3.
	2-4.
X3.	3-1.
	3-2.
	3-3.
	3-4.

If the number of Routine samples needed to cover the distribution system requires that more than three Routine sites are needed, attach additional sheets as needed.

C. Routine Sample Rotation Schedule

Month	Routine Site(s)	Month	Routine Site(s)
January		July	
February		August	
March		September	
April		October	
May		November	
June		December	

D. Month Following Unsatisfactory Samples

Description of Sample Collection Locations for Month Following Unsatisfactory Samples

E. Preparation Information

System Name	Date Plan Completed	Dates Modified
Name of Plan Preparer **Position**		**Daytime Phone #** ( )
State Reviewer	**Date Last Review**	

F. System Map

Examples of Coliform Monitoring Plans

Coliform Monitoring Plan for Island Water System

A. System Information

Water System Name Island Water System	**County** Puget	**System I.D. Number** 123456
System Narrative	Source: Olsen Well, 108' deep (S01) Treatment: None Distribution System: A single pressure zone. Water is pumped from the well to the storage tank. Gravity flow from the tank to all service connections. Storage: 50,000 gallon concrete reservoir Residential Connections/Population: 32/72 Non-Residential Connections/Pop.: 0	
Number of Routine Samples Required Monthly by Regulation: 1	**Number of Sample Sites Needed to Represent the Distribution System:** 3	

B. Routine and Repeat Sample Locations

Location/Address for <u>Routine</u> Sample Sites	**Location/Address for <u>Repeat</u> Sample Sites**
X1. 8570 Hwy 112, front hose bib	1-1. 8570 Hwy 112, hose bib
	1-2. 8640 Hwy 112, hose bib (Us*)
	1-3. 8540 Hwy 112, hose bib (Ds*)
	1-4. storage tank sample tap
X2. 113 Dawn Rd, bathroom sink	2-1. 113 Dawn Rd, bathroom sink
	2-2. 8344 Hwy 112, hose bib (Us)
	2-3. 123 Dawn Rd, hose bib (Ds)
	2-4. storage tank sample tap
X3. 8072 Hwy 112, back hose bib	3-1. 8072 Hwy 112, back hose bib
	3-2. 8092 Hwy 112, hose bib (Us)
	3-3. 8020 Hwy 112, bathroom sink (Ds)
	3-4. storage tank sample tap

* Us = upstream sample site, Ds = downstream sample site

C. Routine Sample Rotation Schedule

Month	Routine Site(s)	Month	Routine Site(s)
January	X1	**July**	X1
February	X2	**August**	X2
March	X3	**September**	X3
April	X1	**October**	X1
May	X2	**November**	X2
June	X3	**December**	X3

D. Month Following Unsatisfactory Samples

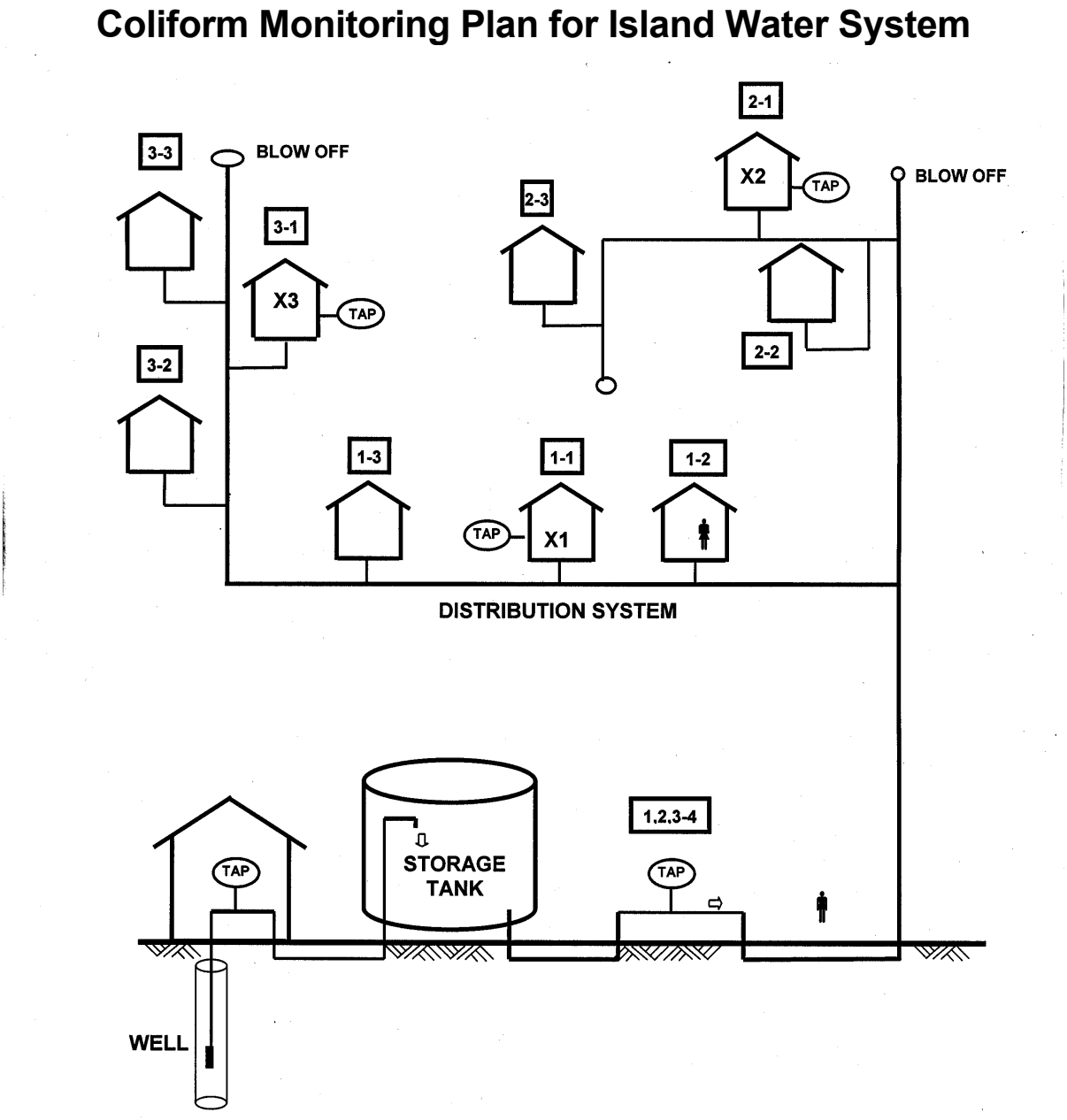
Description of Sample Collection Locations for Month Following Unsatisfactory Samples
The month after a coliform positive sample, five (5) follow-up samples will be submitted,
marked as "Routine" type samples. We will collect these samples from the three (3)
Routine sample sites, as well as from two (2) of the Repeat sample sites. Which Repeat
sites are used will depend on where the contamination occurred.

E. Preparation Information

System Name Island Water System	**Date Plan Completed** 1/5/98	**Dates Modified** 2/12/03
Name of Plan Preparer I.M. Good	**Position:** Certified Operator	**Daytime Phone #** (360) 123-4567
State Reviewer	**Date Last Review**	

System Map

Presented here is a Schematic drawing of the water system.



VOLCANO PUBLIC UTILITY DISTRICT

Our Coliform Monitoring Plan

A. SYSTEM INFORMATION

Volcano Public Utility District
PWS ID # 987654
Basalt County

SOURCES:

DOH source Number	Source Name (Well Depth)
#S02	WELL 1 (540 ft)
#S03	SPRING
#S04	WELL 2 (380 ft)
#S06	BACKUP 3 (280 ft) Well
#S07	BACKUP 1 (420 ft) Well
#S08	BACKUP 2 (330 ft) Well

STORAGE: 5 storage tanks - 250,000-gallon tanks

TREATMENT: A treatment facility, gas chlorination, is located at each source.

PRESSURE STATIONS: 2 booster stations and 1 pressure reduction station enable each of the sources to serve the other areas when necessary.

PRESSURE ZONES: A different pressure zone serves each community. Well 1 is the primary source and Backup 1 is the reserve source for pressure zone 1, Well 2 and Backup 2 for pressure zone 2, and the spring for pressure zone 3. The electrical and pressure controls are designed to allow each source to serve the other two areas in the case of source and back-up being out of service.

POPULATION & CONNECTIONS BY PRESSURE ZONE

	Population Served	Service Connections
PRESSURE ZONE 1 - FOREST HILLS	1520	721
PRESSURE ZONE 2 - AVIARY ESTATES	800	388
PRESSURE ZONE 3 - CITY HEIGHTS	1280	570

TOTAL POPULATION SERVED: Approximately 3,600

TOTAL NUMBER OF SERVICE CONNECTIONS: 1679

B. SAMPLING INFORMATION

ROUTINE SAMPLING REQUIRED BY REGULATION: 4 samples per month.

However, six Routine samples are taken each month to adequately cover each pressure zone, reservoir, and source distribution.

ROUTINE & REPEAT SAMPLE SITE ADDRESSES:

PRESSURE ZONE 1 - **FOREST HILLS**

X1 - Routine Sample Site - 160 11th Court NE
Repeat Upstream - 821 Union Mill Road SE
Repeat Downstream - 819 Union Mill Road SE
X2 - Routine Sample Site - 332 Cougar Street SE
Repeat Upstream - 336 Cougar Street SE
Repeat Downstream - 328 Cougar Street SE
X3 - Routine Sample Site - 252 Hensley Street NE
Repeat Upstream - 248 Hensley Street NE
Repeat Downstream - 77 10th Avenue NE

PRESSURE ZONE 2 - **AVIARY ESTATES**

X4 - Routine Sample Site - 444 33rd Avenue SE
Repeat Upstream - 202 Stanfield Road SE
Repeat Downstream - 448 33rd Avenue SE
X5 - Routine Sample Site - 72 Cayuse Court
Repeat Upstream - 242 50th Avenue SE
Repeat Downstream - 77 Cayuse Court
X6 - Routine Sample Site - 911 Sierra Drive SE
Repeat Upstream - 915 Sierra Drive SE
Repeat Downstream - 907 Sierra Drive SE

PRESSURE ZONE 3 - **CITY HEIGHTS**

X7 - Routine Sample Site - 707 Sunset Drive
Repeat Upstream - 1110 28th Avenue SE
Repeat Downstream - 1106 Maple Hills Drive SE
X8 - Routine Sample Site - 3111 West Street SE
Repeat Upstream - 3107 West Street SE
Repeat Downstream - 915 Arcadia Street
X9 - Routine Sample Site - 911 Sycamore Street SE
Repeat Upstream - 915 Sycamore Street SE
Repeat Downstream - 909 Sycamore Street SE

C. ROTATION:

Biweekly Sampling Rotation Schedule*

	Month 1	Month 2	Month 3	Month 4
Week 1	X1 X4 X7	X3 X6 X9	X2 X5 X8	X1 X4 X7
Week 3	X2 X5 X8	X1 X4 X7	X3 X6 X9	X2 X5 X8

*(This cycle Repeats after the fourth month)

Repeat sample sites are available upstream and downstream of all Routine sample sites.

All water storage tanks can be sampled as necessary.

All sources can be sampled directly as necessary.

D. MONTH FOLLOWING UNSATISFACTORY SAMPLE

Regulations require a minimum of 5 Routine samples in the month following an unsatisfactory Routine sample. Since we collect 6 Routines each month, this requirement is addressed.

E. PLAN PREPARATION INFORMATION

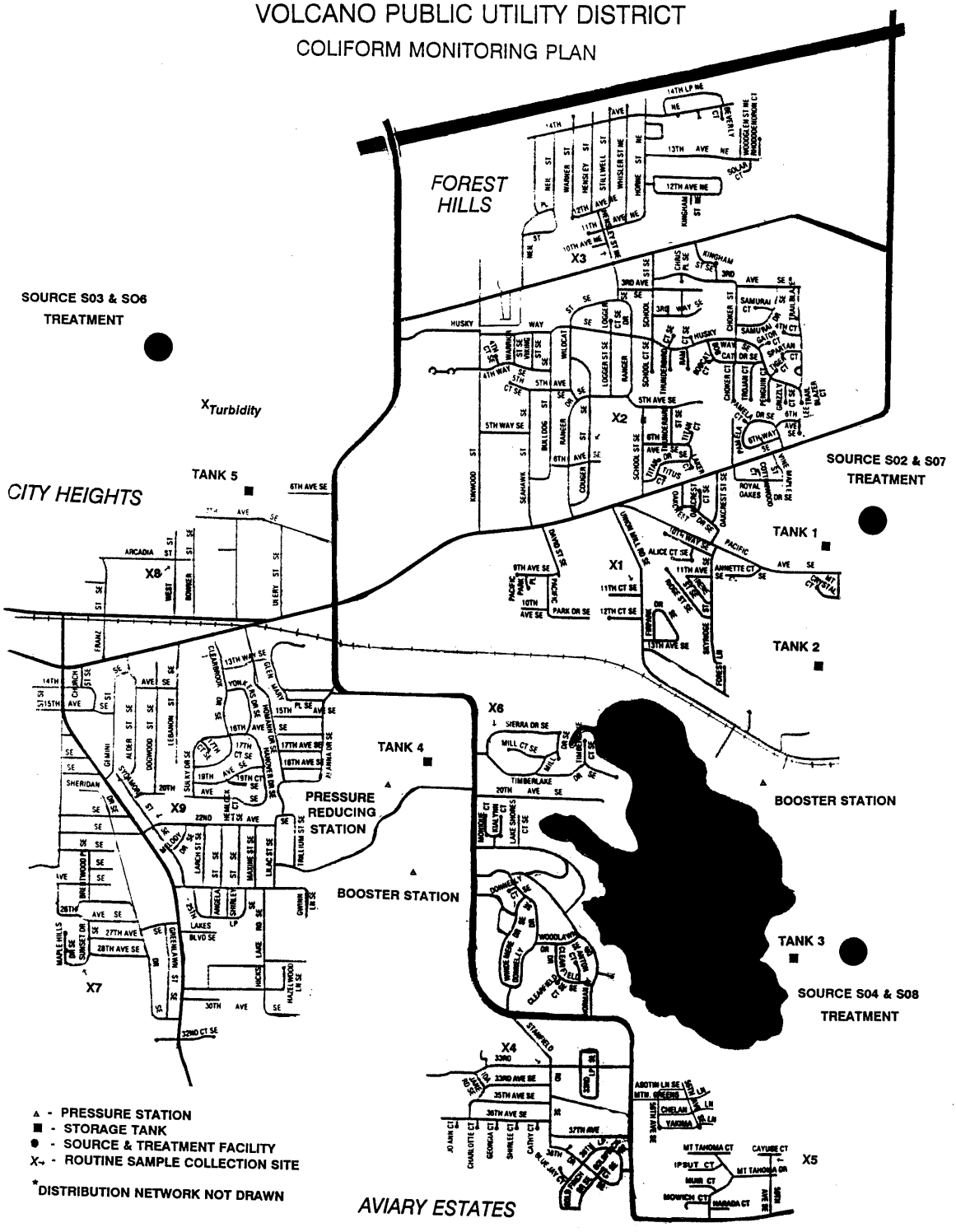
Prepared by Lewis Clark, Engineer, (000) 000-0000
Prepared on: 26 June 1995 / Update 26 September 2002

Reviewed by _____ on __ / __ /.

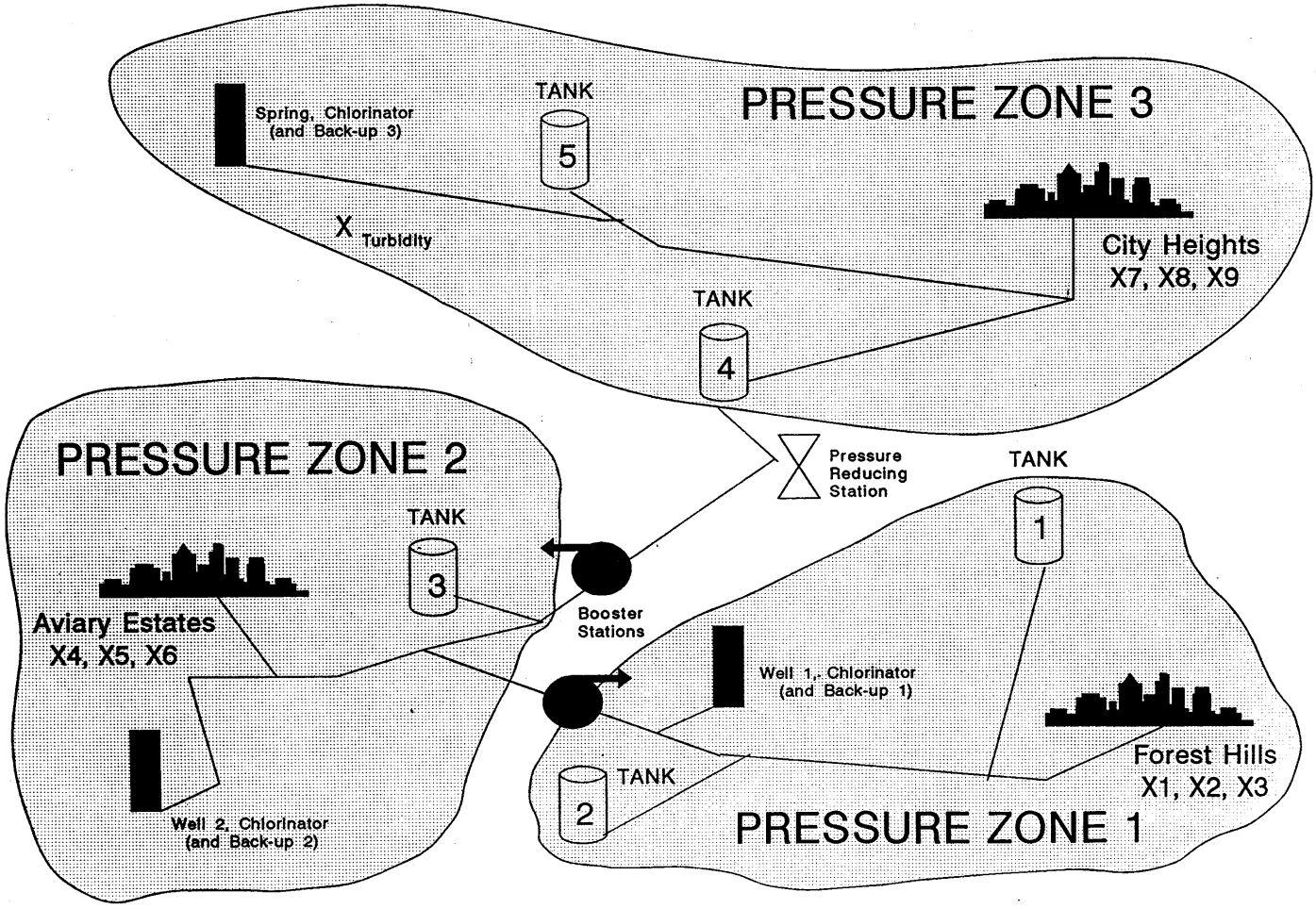
F. MAPS

VOLCANO PUBLIC UTILITY DISTRICT

COLIFORM MONITORING PLAN



VOLCANO PUBLIC UTILITY DISTRICT



Coliform Monitoring Plan Schematic
(not drawn to scale)